DIVERSIFICATION INTO THE UK MARKET FOR LOCALLY PRODUCED TILAPIA.

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ABSTRACT

This paper is focussed upon the marketing implications and adoption responses from a 3 years multidisciplinary Research Councils UK project which has examined the prospects for UK (agricultural) farmers to diversify into production of warm-water tilapia. The proposed production process and product characteristics abound with green credentials, consistent with emergent market demands. This combination might enable small scale producers to access growing UK niche markets for fresh fish and to compete through upmarket positions with expanding EU tilapia imports.

Having ascertained the wider market characteristics primary research was undertaken through consumer focus groups and depth interviews with organisational channel members. The results supported the initial premise of there being niche markets for tilapia produced from local, small-scale environmentally-friendly units. Three target groups in the UK were identified: ethnic consumers, green consumers and discrete segments (gastro-pubs and upscale fish restaurants) within foodservice. Having established favourable market prospects the propensity of farmers to diversify into this novel area of activity was explored.

Investigation of farmer entrepreneurship, undertaken in 2006 and 2007, explored perceived challenges in the new aquaculture venture. In-depth face to face and telephone interviews with agricultural farmers identified a number of factors that both encouraged and dissuaded them from diversification into tilapia. Despite the ongoing interests of some, and other emergent adopters, the majority seem disinclined to commercialise their interest. The paper concludes with an assessment of what might need to be done to promote a more favourable reaction and reviews the prognosis for the success of local fish production.

Keywords: tilapia, marketing, aquaculture, product diversification.

Introduction: project background

This paper reports on ongoing research concerned with a radical approach to sustainable food production meeting the emerging needs of both consumers and small scale producers in the UK. The basis is a recently completed three years multidisciplinary Research Councils UK project which incorporated analysis of markets, public health, entrepreneurial decisions in addition to aquaculture systems and fish husbandry issues (Young et al, 2006). The project focus was an innovative land-based agricultural diversification strategy to produce tilapia, a warm water freshwater fish. Intensification of food production and global markets has encouraged dietary changes in the UK over recent decades (Welch and Graham, 1999) with attendant constraints and opportunities for UK farmers. Modern lifestyles and

influences from ethnic minorities have impacted upon mainstream food culture, evident in growing cosmopolitan consumption patterns and interest in fresh and novel ingredients. Attitudes to the qualities of food, especially fish, have changed with greater focus upon the associated benefits, risks and provenance; an involvement which might be critical to developing marketing opportunities. Relating increasing fish consumption to positive and negative public health impacts has also become commonplace in the media (Burger and Waishwell 2001) although little research has been conducted on the broader implications for public health of UK fish production in terms of wider environmental health impact assessments. Nor have there been any comparative studies of the wider public health impacts of fishing and fish farming.

Sustainable fish production has been pursued globally for decades as wild stocks have declined and aquaculture has emerged as a potential substitute (Young et al 1999). Aquaculture now accounts for almost 45% of worldwide fish consumption (FAO, 2007). However, the prospective contributions and impacts of aquaculture in both developed and developing economies are controversial (Naylor 1998). There are concerns that industrial fish farming models currently dominating production are unsustainable. Major global commodity species, notably Atlantic salmon and tropical shrimps depend on fishmeal feeds derived from capture fisheries (Bell and Waagbé, 2008). The ecological footprint (Kautsky 1997) of these systems is commonly large with deleterious environmental impacts manifest in losses of biodiversity, pollution and other phenomena (Beveridge et al 1994).

Despite the widely accepted positive dietary impacts of eating seafood, increasing evidence suggests some risks to human health through persistent contaminants accumulating in some fish, both wild and farmed (Wong et al, 2003; Serrano et al). Production of tilapia appears to be a relatively 'green' alternative capable of satisfying many such ethical and public health concerns. Ecologically, herbivorous tilapias are highly suitable for low impact aquaculture. Not requiring fish or meat meals suggests their culture might be based on organic and non-contaminated ingredients locally sourced, certified and traceable with potential benefits for the local economy. Although imports of tilapia from the tropics are now common, small-scale production systems in the UK and Europe have become established. These enterprises can produce good quality aquatic foods with near-zero environmental impacts and hold scope for integration within conventional terrestrial farms.

A history of start-up failures suggests that significant constraints exist nonetheless. Enterprises geared towards large scale buyer demands such as supermarkets have often failed. Commonly these units have been based on surplus heat shared with industrial production and /or heated recycled aquaculture systems (RAS). Such systems, now established in Europe and North America, tend to be technically complex with high investment costs thus discouraging prospective adopters from non-specialist farming communities. However such systems provide nutritionally-balanced feeds to very high densities of fish, maintaining water quality and fish welfare through removal of wastes via filtration systems.

Technical issues

Farming fish is not a type of diversification that many conventional farmers have considered but our initial assumption was that many of the skills and resources required would be similar; managing feed inputs, managing fluids in the case of dairy production, basic animal husbandry and other suchlike transferable skills. Many farmers have underutilised farm buildings that if insulated would be suitable for such a purpose; some have access to on-farm energy sources that have little alternative use such as the surplus heat from dairy refrigeration plant, methane from cattle flatulence. Moreover many farmers were attracted to the project concept through an appreciation of how fish might be a valuable and novel product, complementary to their current activities and allowing them to diversify through food production. Initially it was perceived that a culture system that has been promoted elsewhere but was

unproven under commercial UK conditions (Activated Suspension Technology, AST) might be more appropriate rather than a conventional Recirculated Aquaculture Systems (RAS) that was initially viewed as too complex in terms of management and technology. AST is based on the concept of using aerated bacterial floc to convert wastes to natural feed *in situ* that could theoretically allow the use of crops grown on farm as the major feedstock. This approach has been described on a small scale and is in commercial use in some tropical tilapia and peneaid shrimp production units. Theoretically the application of AST within insulated agricultural buildings offers an alternative approach to tilapia production whilst enhancing its ethical and 'local' market values. Both approaches also allow retention of waste nutrients and their reuse locally and have limited, or no, requirements for fish meal and oils in the diets of the herbivorous tilapias.

Conventional heated RASs have tended to be technically complex, high cost and thus of limited appeal to non-aquaculturists. Such systems provide nutritionally-balanced processed feeds to very high densities of fish, maintaining water quality and fish welfare through removal of wastes in separate filtration systems. However tilapia naturally feed on the heterotrophic food organisms that thrive on such waste and will grow provided that water quality, especially dissolved oxygen, can be maintained. In turn, as explained above, the need for inclusion of fish and meat meals in feeds is lessened. This approach, AST, is used commercially in several countries but not yet the UK. Preliminary analysis suggested AST could produce fish more cost effectively than a conventional RAS, even at lower stocking densities that ensure high welfare standards. Moreover, AST could feed fish using locally produced ingredients. If these were deemed compliant and alongside appropriate accompanying husbandry practices, a strong case for organic certification might be made.

Key issues to explore this hypothesis were the relationships between fish density, feeding regime and water quality and their impacts on production efficiency and fish welfare in AST systems. Maintaining warmwater under commercial conditions was not expected to be a major constraint. Preliminary analysis suggested that with modern insulation technologies, energy costs remain below 5% of total production costs. The lack of requirement for special water source or discharge permits meant that such systems could be located almost anywhere, possibly servicing large urban markets. These issues are linked to both marketing of the product, and consumer and governmental perceptions and understanding of what fish farming might bring in terms of sustainability and public health benefits and /or risks.

Despite the apparent merits a series of technical trials established that AST was highly uncompetitive with RAS in terms of production efficiency and in terms of management costs and risk. A comparison of the systems managed on a pilot commercial scale concluded that fish welfare and resource use efficiencies were particularly high for a simple, modular design of RAS. This comparison of technical systems, discussed in more detail elsewhere (Little et al, 2008), is illustrative of some of the technical and financial barriers encountered by prospective adopters. The decision to reject the novel AST system in favour of RAS consumed a lot of project time and resources; and although ultimately not contributing greatly to technical recommendations to farmers, other than what not to do, it provides conclusive information for stakeholders within an emerging and important area of aquaculture. This helps build the evidence base for future investors and promoters and contributes to the knowledge base on sustainable aquaculture strategies. A simplified RAS approach was therefore further developed with inputs of our UK-based commercial collaborators with a view to identifying interested adopters in the UK farming industry.

Market considerations

An integrated approach to identifying market opportunities for various scales of production was pursued throughout the project. Analysis of secondary data found the European market to be relatively small,

c.10,000t, compared with the USA's 170,000t and 2.5Mt globally (Josupeit, 2005; 2007; FAO, 2007). The mainstream UK market appeared to be a comparatively late and slow adopter of tilapia (Sea Fish Industry Authority, 2008). With limited penetration, it was thus decided to use a mixed methods approach involving observational information, consumer focus groups and other sources to generate further insights.

Consumer research began at the 2005 Edinburgh Mela (an annual Asian-based multicultural festival) which drew a diverse green-leaning group to help formulate the research guide. Apart from the directions of the research guide alternative threads embraced topics raised by respondents to capture their perceived relevancies. The focus groups, held in 2005 and 2006, in Glasgow, Stirling, Edinburgh and London included participants recruited via posters in libraries, community halls, groceries and health food shops and cafes. Recruitment was based on upon a self-declared interest in the topic of food and health, plus being a fish consumer.

Ensuing focus group discussions were shaped around the issues identified and progressively explored participants' attitudes towards health, food and fish, the perceived health benefits of fish consumption, sustainable food production, organic fish and participants' awareness, perceptions and purchase habits concerning tilapia. Discussions also touched upon subjects such as fish quality, freshness, packaging and wider concerns with healthy eating, including obesity.

Consumer focus group research clearly identified a strong interest in the pertinent environmental issues surrounding the product. The discussions confirmed several potential niche markets for such 'ethical' fish produced locally, and pertinent data were fed back into the cost models for potential adopters. Qualitative data indicated growing awareness and understanding of the underpinning product concepts, although deeper probing revealed some inaccurate information. Shifts in shopping, notably towards smaller, local outlets and food consumption away from home encouraged individual consumers to be more adventurous and explore alternative markets. Lack of awareness of the emergent options available seemed to present a possible barrier in the short run; however information soon spread through networking and media reporting. Ease, and cost, of access to new outlets of course has to remain competitive. The consumer samples reflected a broad spread amongst the standard socioeconomic criteria of age, gender, socioeconomic class, education levels etc.

Given the time taken to undertake the focus groups it was decided not to include exploration of consumers' perceptions of the actual product. In addition to the practicalities of gaining data pre and post-preparation the focus group room setting was considered to be too artificial an environment to gain reliable data. An in-home placement, with pre and post consumption interviews, was constrained by available funding and instead it was decided to undertake product placement within apposite segments of the foodservice sector.

Product placement

Small scale product placement trials were undertaken with two selected foodservice outlets in Devon, a gastro-pub and a Michelin starred restaurant. The location enabled the supply of fresh locally produced tilapia from the project's commercial partner within a region where customers had regular access to high quality wild captured and farmed fish from the Brixham locality. This provided a competitive test environment and had the additional benefit of availability of commercial fish processing, whose buyers could also be incorporated in the research. The product placement enabled observation of decision making with regards to restaurant food sourcing and menu creation whilst gaining insight into the acceptability of domestically produced tilapia through the reactions of chefs, management and customers.

The participating outlets regularly offered fish options on their menus, sourced local produce and enabled exploration of the proposed target consumers: would they be willing to pay for, try and what did they think of a new or relatively unknown fish product when available in a natural setting? Tilapia was supplied to the establishment free of charge as a whole/round 600g fish then prepared as chefs determined and positioned to diners at a price they felt appropriate. This decision making process was observed and recorded; as were customers in their natural dining environment after which feedback was sought using an informal and semi-structured interview. This case study approach complemented the focus group work and the realistic and natural setting of the experiment allowed insights in to the actual behaviour of consumers when presented with an unknown but locally produced fish product.

In addition to these findings and the focus groups, semi-structured interviews were held with buyers in restaurants, fish wholesalers and retailers which formed a more comprehensive picture of both the potential and limitations of tilapia as an option for the future.

Value chain analysis

Key informant interviews were held along the supply chain centred in the Brixham area with fish processors, wholesalers, fishmongers and further seafood restaurants. Each was presented with locally produced fresh whole tilapia from the project's commercial partner and then interviewed on their opinion of the fish, particularly with regard to their views on its prospective position within the market. Comments from all quarters were highly favourable. In keeping with the product placement trials, the restaurants in Brixham and Dartmouth were left samples for chefs to prepare and place on their menus. This was followed up by face to face and telephone interviews to discuss their findings. Generally these were also very positive and confirmed the earlier results. One notable exception concerned a restaurant run by a TV 'celebrity' chef who refused to comment because the fish was farmed and thus would not be served in his establishment. This reaction was interesting as it highlighted some of the biased and subjective opinions that farmed fish producers might encounter, irrespective of the objective merits of the product in terms of freshness, quality and environmental attributes.

The combined explorations of consumers and other actors within the marketing chains revealed strong and emergent interests in sourcing, buying and consuming fish products like the tilapia proposed. Limited availability of products fully satisfying desired quality and environmental criteria was reported and the tilapia appeared to be in a favourable position to capitalise upon this situation. Within foodservice chefs consistently reported a willingness to pay reasonable premiums so long as quality and other attributes were maintained. However despite expressed willingness to pay price premiums, normal commercial practice might encourage some periodic resistance within market sectors.

The production characteristics of tilapia identified were perceived to be valuable, not least because of evident demand for sustainable and eco-friendly food production. Understanding such demand and opportunities for marketing the product was a key issue and linked to understanding potential adopters capacity for both production and marketing. Such a food production system has broader implications than the improved livelihoods of mixed farms in the UK however. Recent research has identified the nation's poor diet as major contributory factor in health costs and increased fish consumption is being widely advocated as an important measure to correct it. This occurs at a time of enhanced consumer concerns with the sustainability of wild fish stocks and suspicions over conventional aquaculture products on the grounds of their potential impacts on both health and the environment. The project identified various groups of consumers that currently eat fish and might be interested in availability of tilapia produced within the UK as a starting point for understanding the nature of the market(s) for such a 'new' product.

Coincidentally, a new start-up tilapia tilapia producer based on a contract farming model appeared in the UK during the project and gave an opportunity for observation of the viability of a larger-scale, supermarket driven approach. For a variety of reasons, this approach proved particularly risky. Its problems did however stimulate the successful initiation of a seed producer with whom there was exchange of both technical information and experience. Having identified seemingly favourable characteristics of the production system and its output, the residual and ongoing focus has been placed upon exploration of the interest and capacity among both farmers and other stakeholders in using tilapia as a diversification strategy.

Adopting diversification

Assessment of farmers' propensity to adopt the tilapia diversification strategy was begun by gaining understanding of farmers' current interest in, and practice of, diversification. This was informed by discussions with Government agencies working to promote and support rural diversification. This expertise aided identification of communication channels with target adopters and other institutions that might support this novel activity. Taking on the role of facilitators and providers of neutral, research-based information, the multidisciplinary research team sought to engage their interest and understand their motivations and constraints.

An action research methodology was designed and implemented iteratively and led to dissemination of guidelines through interactive dialogue with potential adopters. Initial dissemination of project objectives was via the project website, followed up by key informant interviews with individuals involved in agriculture and farm diversification in Scotland. From this a database of potential adopters was developed. A series of face to face interviews was undertaken with a cross section of farmers in Central Scotland with, and without, diversification experience; in these entrepreneurship issues were the focus of discussion.

The tilapia diversification concept was subsequently launched at livestock auction markets in Central Scotland; these drew buyers and sellers farmers from afar and locally and farmers traditionally spend part of their time networking and discussing current farming news. Poster displays, a scaled production unit and a chef cooking samples of tilapia sent from the commercial partner gave farmers the opportunity to see and taste the concept from farm to fork. Most were new to the species and this tangible engagement overcame many problems of hypothetical explanations. Informal discussions gave further insights and additions to the database. This approach provided enhanced links with a limited number of individuals to assess how adoption of tilapia farming might work.

Having established clearer insights into the more critical issues a presentation meeting was held in Perthshire with a cross section of the farming community. Thereafter further dissemination used TV, radio and printed press channels, including UK and Scottish farming publications which generated considerable interest. An information pack, incorporating and integrating findings from all disciplinary perspectives, was generated giving guidelines for starting up small scale tilapia production; this was circulated using the database. Feedback was invited through email or telephone interviews and this iterative process helped inform the decision-making process for potential adopters.

Entrepreneurial responses?

Over 150 separate responses to the media cover were received which expressed interest in the potential for small-scale production, distribution and marketing of tilapia from RAS. Analysis of the responses suggests that both distress and success factors motivate farmers to look outside their current situation for

new opportunities; both bring their own challenges with respect to converting interest into action. Issues of opportunity and necessity to diversify from conventional agriculture are fundamental in any assessment of motivation to change, especially where it involves movement away from a production based subsidy. Recent growth towards organic and local foods has also increased awareness of the market potential. Concurrent expansion of farmers' markets, organic box schemes and suchlike have underlined more widespread public empathy with food produced locally and ethically.

From the trials data, cost benefit assessment showed that a breakeven price of £3/kg was required for viable small-scale production. Although this price represents a modest hurdle when set against prevailing market prices for competing products, it clearly did not alleviate all concerns. After often lengthy consideration of both technical issues and market characteristics the perceived risks outweighed the potential returns for the majority to develop a pilot system. Producers perceived a more significant barrier concerning their ability to service sufficient buyers to be financially viable, especially where seasonal fluctuations in demand might be expected. The absence of a tried and tested market model made many unwilling to extend their operational boundaries. Yet clearly this producer-led resistance to expansion of market outlets could present a barrier to consumer access and thus greater acceptance, a classic chicken and egg dilemma. Other producers reported the parallels with other types of diversification, especially related to concepts of greener, local food.

The emphasis upon 'small scale' production and niche markets served suggests that communications would best rest upon word of mouth and other below the line activity. The characteristics of the target buyers suggest the success of the venture depends upon perceptions of what the product actually delivers, rather than any alternative claims that might be communicated. Both foodservice and retail buyers and consumers consistently emphasised product quality to be critical. Given the structure of the value chain, and its competitors, the freshness of the product is the key USP and the key point of comparative advantage and potential success. Consistent delivery of this USP is thus likely to be vital.

One evident constraint to adoption was concern about market intelligence. The diversification was felt to be radical, beyond their area of expertise and knowledge base so presenting a steep learning curve. At the extreme, some producers opined they would never contemplate the move because it was fish and not meat. Other producers who had diversification experience of other products (notably horticulture) were keen to simply apply the same model with little regard for the specifics of fish; a potentially high risk strategy given the particular demands of fish. The majority held a more balanced view recognising the need to explore the market for fish, although not certain of the best means of doing so.

Respondents had very limited awareness of publicly accessible market intelligence, and critically, exploration of possible grant support for this by some prospective adopters revealed scant availability of assistance either to aid marketing intelligence or subsequent application. This highlighted a significant flaw in policy: the provision of support for new product diversification appears to be encouraged with no corresponding attempt to enable prior market assessment. This might be noted as conflicting with good business practice and a potentially significant waste of public money. The apparent reluctance of Government agencies to support both production and marketing start-ups of small-scale aquaculture have also proved a problem since such scheme attributes often disallowed support for the type of pilot required to establish the approach in a commercial environment.

Some doubts might also be raised about the impact of data provided by the research whereby many of the normally unknown factors had been revealed through the research programme. Possibly more accurate reflections on farmers' propensity to adopt might have been gained if information had been made more opaque. For future research one approach to assessing the significance of the quantity and quality of the information provided in advance of the diversification decision may be to reveal different amounts to groups in geographically distant areas. Notwithstanding the risk of cross communications via other

channels, there may be some opportunity, possibly through interim interviews, to gain greater insight to critical levels of information provision at different stages in the decision making process. This would of course raise not insubstantial ethical issues concerning the welfare impacts upon the adopters.

Conclusions

New approaches to sustainable food production meeting the needs of producers, consumers and other channel intermediaries are urgently required. Despite earlier noted changes in food production, marketing networks and greater diversity of influences on contemporary food culture diet (Welch and Graham, 1999; Anon, 2002), a number of problems remain. Despite growth in the appropriate variety of food available as one of a number of influences on human health, measurable improvements in public health are unlikely to appear for several years. Many indicators now reveal there will be major future problems associated with poor eating habits in large sectors of the population. In particular, the relative growth of processed 'fast' foods in the diet is believed to be having a deleterious effect, but strategies to inform and provide consumers with healthier and more informed dietary choices appear largely ineffective among the target groups (Glanz, 1999). The potential benefits of increased consumption of particular fish have failed to reach many target groups. Even where the products have been price competitive such as pelagic fish species noted by Gofton & Marshall, 1992, some prefer to consume the benefits only via more expensive functional products such as fish oil capsules.

Expanding menu choices in the UK's foodservice and retail niches offer opportunities for suppliers of new products to meet appeals of different socio-cultural groups and with varied willingness and ability to pay. Fish produced locally and sustainably forms part of this myriad with potential appeals to green, ethical, health and other attributes. However there are many competing alternative food products available which may discourage the decision to diversify. .

Recognition of the benefits and problems generated by aquaculture developments has focussed interest in new species and culture systems with fewer negative environmental impacts and more social benefits. Organic and traceable fish have been favoured but the predominantly carnivorous species raised and the open cage culture systems used have restricted available options (Aarset et al 2004). Such aquaculture development has largely passed by mainstream UK farming communities and has centred within large-scale commercial interests particularly in coastal Scotland.

This research contributes to understanding of the feasibility of an alternative approach to aquaculture, investigating the integration of tilapia into mainstream farming which could generate a supporting income stream to the farm and its local economy. Concomitant positive public health outcomes, at the workplace and community levels might also be expected. The concept could both permit diversification and benefit a different producer group whilst supplying UK niche fresh fish markets. Farm diversification in the UK typically generates very modest income growth (<£6000 net profit annually (UoE, 2002)) and the scale of development is critical to avoid undue risk and encourage participation. The proposed production is based on principles of neutral or positive environmental impacts and ensuring animal welfare considerations. Other potential benefits include reduced food miles; fresher, more accessible and healthier food.

The research project remains ongoing with further expressions of interest in commercialisation. Whilst preliminary results discussed indicate a generally risk-averse attitude to the adoption of the proposed diversification, a small number of more innovative producers have shown signs of adoption. Concerns either about the husbandry and the novel challenges of fish, or the lack of awareness about the market for fish remain common fears. Some farmers demonstrated some degree of market orientation, through downstream involvement with customers, but many perceive the market for fish to be particularly

challenging and difficult. This perception is unlikely to be lessened until a more holistic perspective is taken on grant assistance to cover the entire marketing chain.

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